ELFT-EFS
NIST Evaluation of Latent Fingerprint Technologies: Extended Feature Sets

1 Purpose

This is an evaluation of automated latent fingerprint matching software. The purpose of this evaluation is to determine the effectiveness of human latent examiner-marked fingerprint features on latent fingerprint search accuracy, specifically with respect to the comparative accuracy of image-only searches, image+minutiae searches, and image+extended feature searches.

2 Background

Recent work in latent fingerprint matching has focused both on increased automation (image-only latent matching), and extended features:

- The NIST ELFT evaluations and operational AFIS have shown that image-only latent searches are practical, with some promising fully automated image-only latent matching results — but an evaluation needs to be conducted, using new data, that investigates the comparative effect on accuracy of image-only and feature-based searches, and can provide data to determine what characteristics will maximize the accuracy of automated searches.
- A (draft) standard method of defining a comprehensive set of friction ridge features has been proposed through the work of CDEFFS [1]. This Extended Feature Set (EFS) specification allows examiners to define what they see in an image — but an evaluation needs to be conducted that investigates the comparative effect on accuracy of EFS searches over traditional minutiae searches. It is critical to note that these features have a cost in examiner time: human latent expertise is a limited resource. Latent print examiners have marked minutiae for AFIS searches for years. Asking latent examiners to spend to the time to mark up a new feature for an AFIS search is only worthwhile if there is a clear benefit with respect to matcher accuracy.

This evaluation seeks to address the needs of decision makers to determine how to optimize efficiency and accuracy when conducting image-only, image+minutiae, and image+extended feature searches.

3 Path forward

Summary of path forward:

A. Public challenge dataset (SD27-1000 – see below) is already available, without Extended Feature Set (EFS) markup. *(Available on request. SD27-1000 latents have been included in all ULW versions since August 2008)*
B. Public challenge dataset (SD27-1000) with juried EFS feature markup will be made available. The dataset will be released incrementally as markup is completed. *(In progress: data will be released before the workshop (D))*
C. Comments will be solicited from potential participants with respect to the overall impact of EFS on matcher accuracy, comments on the potential usefulness of the various features, and comments on methods of marking the EFS in the public challenge dataset.
D. A workshop will be held to provide input to NIST in the planning of a challenge evaluation of matcher algorithms using various combinations of EFS features. If appropriate, the EFS specification and/or the guidelines for its use will be revised in response. *(Scheduled for 19-20 March 2009 at NIST, Gaithersburg MD)*
E. A challenge problem will be conducted, at the participants' facilities, using the public challenge data, with self-reported results.
F. A workshop will be held to discuss the results of the challenge problem, lessons learned, and to provide input to NIST in the planning of the actual evaluation. If appropriate, the

[1] ANSI/NIST Committee to Define an Extended Fingerprint Feature Set — see http://fingerprint.nist.gov/standard/cdeffs

EFS specification and/or the guidelines for its use will be revised in response. If appropriate, the public challenge dataset will be revised in response and made public.

G. Based on the findings of the challenge problem and workshops, NIST will conduct an evaluation of latent feature matching, using participants' software on NIST hardware at NIST facilities. The evaluation dataset will be sequestered data, marked up in accordance with the findings of the challenge problem. The images in the evaluation dataset will be different than the ELFT Phase II dataset.

4 Public challenge dataset (SD27-1000)

A sample dataset of latent and exemplar images, with juried human markup of most or all EFS features, will be made available before the test. The public (challenge) dataset will be based on the SD27 dataset, which has been rescanned at 1000ppi (now described as SD27-1000). The SD27-1000 latents with juried minutiae markup (not other EFS features yet) were included in the ULW 5.4 release (August 2008). The full 14-image 1000ppi exemplar sets for SD27-1000 are currently available – but without feature markup. These can be sent to interested parties within the next few weeks if requested.

Juried feature markup entails multiple expert human latent examiners conferring to create an "ideal" markup that is as objective as possible.

For the challenge problem, the gallery (background) data will include the rolled 10-print sets from SD27 (mates of the latents, at 500 or 1000ppi), along with SD29/SD30 as unmated background, for a total of approximately 450 subjects. Exemplars for the gallery will be images only. Different tests will be run with 500ppi and 1000ppi exemplars. Note that SD29 and SD30 contain the same images from 216 subjects, only differing in that SD29 was scanned at 500ppi and SD30 was scanned at 1000ppi.

5 Proposed outline of challenge problem

The following is a proposed outline of the planned challenge problem:

- The challenge problem will involve 1:N searches using latent 1000ppi images provided with human groundtruthed (juried) markup of CDEFFS features.
- Exemplars for the gallery will be images only. Different tests will be run with 500ppi and 1000ppi exemplars.
- The challenge problem will be conducted at the participants' facilities, using the public challenge data, with self-reported results.
- Different tests will be run for the following search types:
  - Image only
  - Image with minutiae
  - Image with minimal/various sets of CDEFFS features (comments requested on what this would involve)
  - Image with complete set of CDEFFS features
  - Some tests may evaluate performance of features without image.

6 For further information

As additional information becomes available, updates will be made at the ELFT-EFS website (fingerprint.nist.gov/latent/ELFT-EFS), with notifications sent to interested parties.

To register as an interested party, please send contact information (name, affiliation, email, telephone) to latent-efs@nist.gov.